

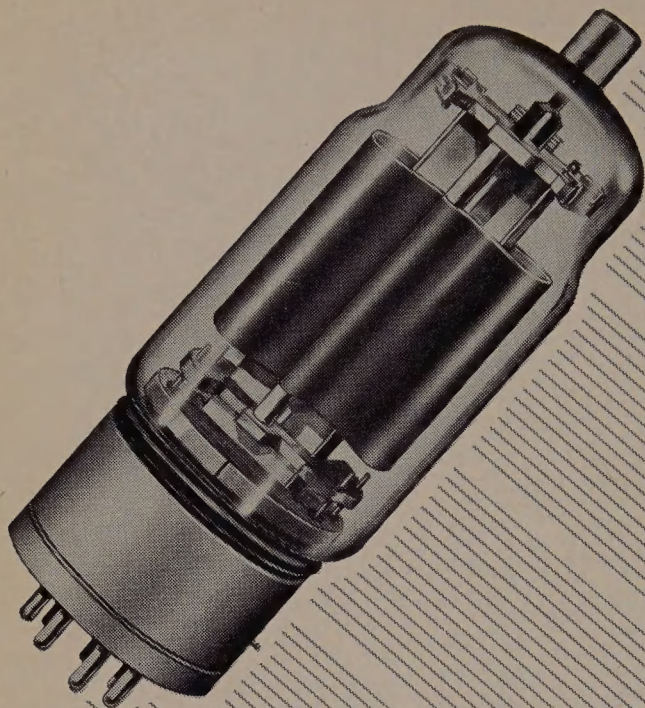
May, 1945

The Chemist Analyst

VOLUME 34

NUMBER 2

Published by J. T. BAKER CHEMICAL CO.
PHILLIPSBURG, N. J.



Measured purity contributes to the wonders of ELECTRONICS



Electronics—the new science of putting the electrons to work!

Today . . . the electron tube helps control the quality of countless products of war . . . guides the destinies of armies and fleets all over the world.

Tomorrow—this miracle-working tube which sees, hears, tastes, feels and smells with amazing sensitivity—will revolutionize our peace-time lives.

It will invade industry in all its aspects, save energy, save time, save money, protect life and property.

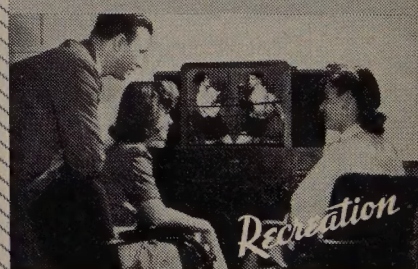
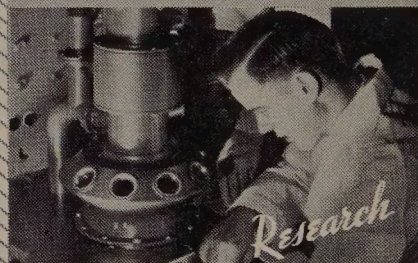
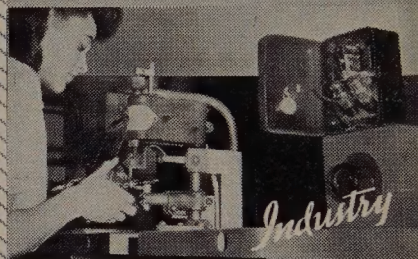
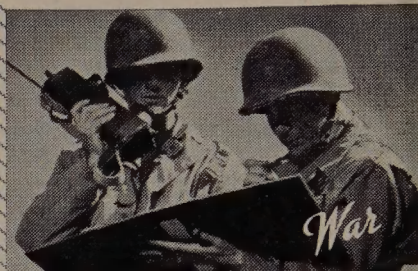
Baker is playing its part in contributing chemicals of extraordinary purity to make possible the coating of the filament used in the electron tube. Here, *purity is demanded*—so that transmission of electronic power may not be impeded.

This is only one of the many instances where *purity*, as exemplified by Baker Chemicals, has increased efficiency in today's forward march of industry.

Baker's Chemicals (purity by the ton) have been supplied to many manufacturing concerns for the manufacture or processing of many products.

If you have special chemical requirements for war, or post-war production products, we invite you to discuss your needs in confidence with Baker.

J. T. Baker Chemical Co., Executive Offices and Plant: Phillipsburg, New Jersey. Branch Offices: New York, Philadelphia and Chicago

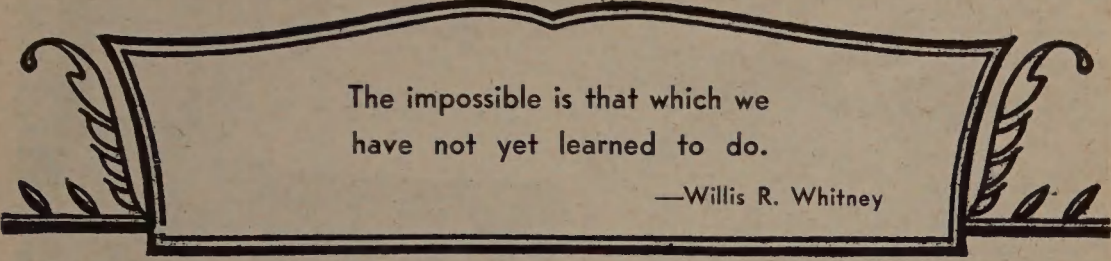


Pictures courtesy Radio Corporation of America

Back the Attack with War Bonds!



"Baker's Analyzed" C. P. ANALYZED • FINE • INDUSTRIAL



The impossible is that which we
have not yet learned to do.

—Willis R. Whitney

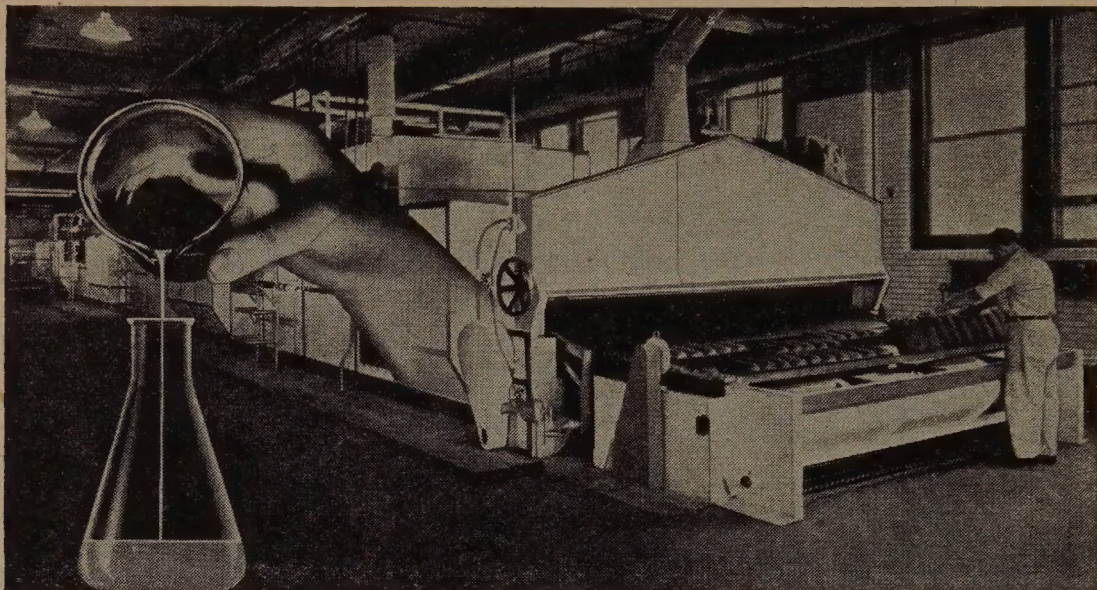
Table of Contents

Detection of Beryllium in Copper-Base Alloys	Frank Kulcsar	28
Slide Rules for Rapid Solution of Special Equations.....	Joseph T. Hogan	29

LABORATORY SUGGESTIONS

Note on A.S.T.M. Test D 61 - 38	E. Pasold	40
Self-Draining Filtering Flask	John Simila	41
Collection of Spilled Mercury	E. T. Pinkney R. S. Young	42
The Suck-Seal	Arthur Furst	44
Concurrent Humidity Tests at Various Relative Humidities	Alex Newhouse James H. Steele	45
A Sampling Device	Richard W. Stow	46
Adjustable Constant Temperature Bath	E. C. Urban J. A. Dietz	47
Miscellany		48

This company is not responsible for the authenticity and originality of articles herein contained. They are offered for the service they may render. For re-publication of any articles permission must first be obtained from the editor.



GOOD NUTRITION FOR AMERICA

... starts in the laboratory!

Someone has said, "What we eat we are!" But few realize that good health frequently is charted in the laboratory!

Soils vary in chemical content and so do crops that are grown on them! The feed intake of livestock frequently determines the nutrient values of meat, eggs, milk, etc. Vitamin and mineral fortification of food has been made possible through laboratory analysis. Laboratory analysis has indicated not only the need for but also the degree of enrichment necessary. Truly, America's good health starts in the laboratory.

In the laboratories (product control rooms) of many of the leading food and food processing manufacturers, you will find effective tools to measure good nutrition. They are

"Baker's Analyzed"

C.P. Chemicals and Acids. The reason these Reagents have been selected is unique, for **"Baker's Analyzed"** C.P. Chemicals bear this distinction. Each bottle has the ACTUAL LOT ANALYSIS ON THE LABEL. The small percentages of impurities by lot analysis, as found by Baker's analysts, are printed on the label.

Chemists who work in terms of third and fourth decimal exactness know the value of the actual analysis rather than a statement of maximum limits of impurities.

So on your next order, be sure to specify **"Baker's Analyzed"** C.P. Chemicals and Acids. Your favorite laboratory supply house can supply you.



THE CHEMIST-ANALYST

MAY, 1945

VOL. 34, NO. 2

Published by J. T. BAKER CHEMICAL CO., Phillipsburg, New Jersey

Subscription rate, 12 issues \$1.00 in U. S. and Possessions. Canada and Foreign \$1.50

S. B. WILDRICK, *Editor*

When I was a boy, I watched my father graft to a fine apple tree the branch of another selected strain, so that the tree's life sap, fed from the deep roots, made the new branch live, grow, and produce.

Here at the J. T. Baker Chemical Co. we have adopted this lesson from nature.

For 40 years, all our thoughts, energy and research have been devoted to inorganic chemistry. Market surveys of our customers' future chemical needs, however, caused us to decide that a new branch of service in organic chemistry was needed.

In the February CHEMIST ANALYST we told you about the appointment of Dr. Joseph R. Stevens as Director of Organic Research. Now Dr. Stevens in turn announces several recent appointments to his staff, with more to come later.

As design chemical engineer, Mr. John Burton, B. S., Rhode Island State College. For the past six years with Heyden Chemical Co.

As development engineer, Mr. Augustus Buzas, B. S., Rutgers University, 1940. For the past five years with Merck & Co., Inc.

As research chemist, Dr. Ralph Moore, Ph. D., McGill University, Montreal, Canada. For the past seven years with Arthur D. Little Inc. as research organic chemist.

In addition to these three appointments, Dr. Stevens has appointed Miss Jeanne Ossent, M. A., Barnard College, as technical librarian. Miss Ossent was previously in the employ of Rohm and Haas.

These carefully-chosen, competent people will have the advantage of the J. T. Baker Chemical Co.'s deep-rooted, over all chemical experience and, above all, will share its determination that only the finest chemicals, whether inorganics or organics, shall bear the trade name, Baker.

Detection of Beryllium in Copper-Base Alloys

FRANK KULCSAR

The Brush Beryllium Company, Cleveland, Ohio

The spot test developed by Komarovskii and Poluektov (1) provides a fairly rapid, reliable means of detecting beryllium in copper-base alloys.

Some thought was given to the possibility of using micromethods, but from the standpoint of general ease of manipulation and simplicity of apparatus it was decided to use macromethods. Modifications using microtechniques on aliquot portions of the nitric acid solution will readily suggest themselves to those trained in such work.

Reagents

Potassium Cyanide. A 25% solution of KCN, stored in a rubber stoppered bottle.

p-Nitrobenzene-azo-orcinol. Dissolve 25 mg. of the crystals in 100 ml. of N NaOH, and store it in a rubber stoppered bottle. Since the solution slowly deteriorates, it is best to prepare a new one every two or three months.

The *p*-nitrobenzene-azo-orcinol can be purchased from the Eastman Kodak Company. It may, however, be made from *p*-nitraniline and orcinol in accordance with the directions given by Komarovskii and Poluektov (1, 2).

Procedure

Place approximately 1 g. of drillings in a 600 ml. beaker and add about 40 ml. of concentrated HNO_3 . After vigorous action subsides, heat on a hot plate to complete solution and expel oxides of nitrogen. Dilute to about 300 ml. with water, stir and heat just to boiling. Then add NH_4OH until the solution smells strongly of ammonia. Filter through a No. 41 H Whatman paper, washing the paper and precipitate twice with a slightly ammoniacal 2% NH_4NO_3 solution. Discard the filtrate. Any beryllium present is dissolved by treating the precipitate on the filter paper with 10 ml. of a 10% NaOH solution. (If the precipitate is gelatinous, it is advisable to break it up as much as possible with a policeman immediately after adding the NaOH solution.) Allow the solution to drain completely and then discard the filter paper. This solution is tested for beryllium as follows.

With a stirring rod place two drops of the *p*-nitrobenzene-azo-orcinol solution on a double thickness of filter paper and to the same spot add one drop of the 25% KCN solution. Then, with a small stirring rod, place in the center of the spot a small drop of the solution to be tested. A pink coloration indicates the presence of beryllium. When the alloy contains a very small percentage of beryllium, a pink coloration may not be produced immediately. Allow the spot to dry, meanwhile watching it carefully. If no pink is ob-

served by the time the spot is completely dry, the sample in question contains less than 0.05% beryllium. No conclusion should be drawn once the spot becomes completely dry, as the color tends to fade.

Notes: (a) Practically any kind of filter paper can be used for these spot tests, but a smooth surface paper gives the best results. Munktell No. 1 F paper was found to be excellent.

(b) The best light for observing the pink coloration is bright daylight. Direct sunlight should be avoided, however.

Sensitivity

When one gram samples of several different alloys were tested with the foregoing procedure, it was found that the least amount of beryllium which could be detected was approximately 0.2 mg. An alloy containing 1.54% silicon proved to be an exception, 0.2 mg. of beryllium giving a negative test; but subsequent work showed that 0.5 mg. could be easily detected in this particular alloy.

Continued on page thirty-nine

Slide Rules for Rapid Solution of Special Equations

JOSEPH T. HOGAN
New Orleans, La.

The use of the slide rule for solving equations dates back to the year 1683 when Thomas Everard, a mechanic and excise officer at Southampton, adapted the logarithmic scale of Gunter for the computations involved in determining the cubic content of measuring vessels and containers of market commodities. On his rule were marked the "gauge points" or numbers often used in slide rule settings for standard measurements and conversion factors.

Besides the various slide rules which have become more or less standardized today, the technician and designer are familiar also with the many forms which are specially constructed for certain purposes or have special scales for particular types of problems or calculations. A cursory glance through any technical journal reveals the numerous rules sold or given away by various supply houses. Each rule in general aims to solve some complex problem or equation by a simple setting of slides, or perhaps an addition or subtraction, with reasonable accuracy.

Modern engineering literature indicates a marked increase in the use of special slide rules, and a knowledge of the general principles involved in their construction should result in a more intelligent use of them. Therefore, it is hoped that by presenting a method involving only simple algebraic manipulations, many individuals will learn that the construction of such rules is as simple as their application.

In order to justify the time spent on the design and construction of any special rule, an increased efficiency should be realized in its application to the problem solved. Whether or not a slide rule for the solution of an equation will warrant the time spent in its construction will depend upon the difficulty encountered in solving the equation, the frequency with which the equation must be solved, the time spent in constructing the rule and the accuracy obtainable. Routine problems of design are frequently worthy of such effort. In the reduction of many thousands of observations one large corporation had non-technical employees help solve problems by means of special slide rules. In addition to accuracy, a time efficiency was reported by their use. Since increased efficiency is the principal objective, simplicity should be the keynote in their construction. The simplicity of application of the slide rule is responsible for its popularity.

Theory and General Equations

The characteristics of any slide rule consist of the proper location of the scales with respect to each other and the relative magnitude of the coordinates used thereon. The mathematics of the slide rule involves the mathematical determination of these characteristics to permit construction.

A "scale" may be defined as a straight line carrying graduations which correspond with a set of numbers arranged in the order of their magnitude. The linear distance, measured from some zero point to any number, represents the value of the function for that number. Since a variable in an equation may be raised to any power, have any coefficient or appear as a logarithm, trigonometric function, etc., it is necessary to prepare scales to meet these conditions. If the function is linear, the successive divisions or distances between numbers are uniform; if the function is non-linear, then these distances vary and the scale is non-uniform.

The "scale modulus", denoted by m , may be defined as the length of scale per unit of the function. The length of scale is equal to the scale modulus multiplied by the range of the variable or function of the variable.

$$\text{Scale Length} = \text{Modulus} \times \text{Range}$$

Thus, if a scale 10 inches in length embraces a function ranging in value from 5 to 10 in that distance, the scale modulus is

$$m = \frac{10}{10 - 5} = 2$$

The equation of the scale is then expressed by

$$y = m f(x)$$

where m is the scale modulus, $f(x)$ is the value of the function for the given value of x , and y is the linear distance represented by $f(x)$.

Every slide rule operates on one simple principle, the addition or subtraction of scales the lengths of which are proportional to the values of the functions plotted on the scales. If two scales be drawn so that their divisions are equal throughout, the sum of any number of units of one scale and any number

of units of the other may be determined mechanically. In Fig. 1, any number on scale *A* is opposite the sum of itself and 3 on scale *B*. Thus 3 of *A* and 6 of *B* are opposite one another; and similarly for 4 and 7, 5 and 8, and so on for the full range of the scales. Conversely for subtraction, any two numbers whose difference is 3 will be found opposite one another on *A* and *B*. It will be remembered, however, that in adding logarithms of numbers, the logarithm of their product results and in subtracting them the difference is the logarithm of their quotient.

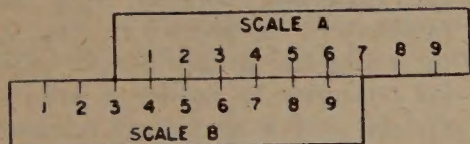


Fig 1.—Mechanical addition and subtraction with linear scales.

Whenever any equation representing the relationship among several variables can be expressed as an addition or subtraction of terms, then the equation can be adapted for use on a slide rule. It is important, however, that each term for which a scale is to be plotted contain only one variable.

Consider the following equation as representing a typical example of the conventional form to be plotted:

$$X - Y + Z - P = K$$

where *X* is a function of *x*, *Y* is a function of *y*, *Z* is a function of *z*, *P* is a function of *p*, and *K* is a constant.

The above equation, expressing the relationship among the four functions *X*, *Y*, *Z* and *P*, is in a form representing the addition and subtraction of terms containing one variable each. Thus it fulfills the requirements for adaption to the slide rule. If the values of any three of the terms are known, then the value of the fourth may be determined. As arranged above, function *X* would be plotted on the lower stationary scale and function *P* on the upper stationary scale, function *Y* on the lower part of the movable scale and function *Z* on the upper part of the movable scale. Then if a known value of *Y* is placed opposite that of *X*, the required value of *P* is found above the known value of *Z*. The order of arrangement of scales is an arbitrary one, but for the sake of simplicity it is best to let the last term, *P* in this case, be the unknown quantity to be solved for.

After determining the arrangement of scales, the limits of each variable should be set and the relative magnitude of the coordinates of each scale calculated by selecting a scale modulus. The scale modulus should be chosen so that the largest scale can be plotted within the limits of the slide rule blank. Thus, if a 12 inch blank is used for a function ranging from 10 to 50 in a linear distance of 10 inches, then the scale modulus to be used is

$$m = \frac{10}{50 - 10} = 0.25$$

After selecting a scale modulus, the length of each scale is determined using the relationship:

$$\text{Scale Length} = \text{Modulus} \times \text{Range}$$

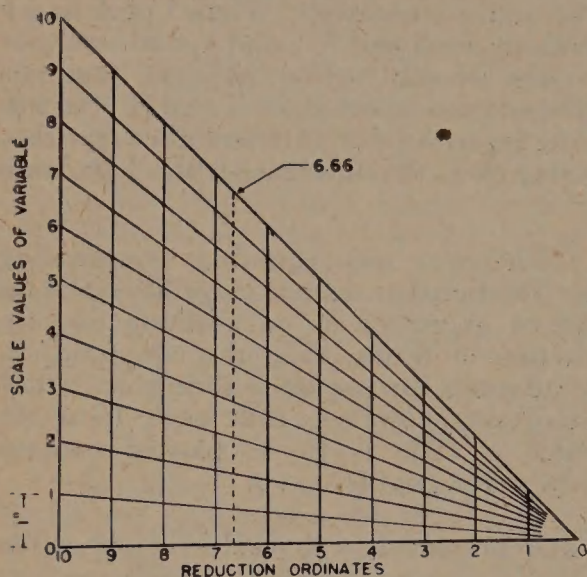


Fig. 2—Method of obtaining desired size of coordinates by means of projection. The graduations of the full size values on ordinate 10 line are obtained by use of standard coordinate paper.

standard ones on the 10 line. Standard coordinate paper can be used to advantage for obtaining the markings of the scale along the 10 line. By projecting the respective points to any other line selected, the desired size of scale graduations may be obtained.

The graduations of each scale are plotted on a strip of stiff paper and the scales are then ready to be placed in their proper positions on the slide rule blank. To avoid having an abnormally long rule it is best to place the two longest scales such that their end values (either right or left) are in close proximity to each other. Scale *X* is permanently fixed and the proper positions of the others then found by solving an example using known values of the variables. When the proper alignment is obtained, each scale is permanently glued in place. Finally the rule should be checked by solving a number of problems, the answers of which are known.

Each scale should be properly marked and the equation expressed to prevent any uncertainty as to its use. Since useful rules often find wide distribution, they should preferably carry the name of the individual or organization originating them in order that proper credit may be received.

To illustrate the application of the above principles, an equation will be plotted for use on the slide rule.

When an electric current flows through a resistance, the number of heat units developed is directly proportional to the square of the current, the re-

sistance and the time the current flows. The relationship may be expressed by the following equation:

$$P = \frac{I^2 RT}{4180}$$

where P is the number of kilogram-calories, I is the current in amperes, R is the resistance in ohms, and T is the time in seconds.

The equation may be expressed as an addition and subtraction of terms by applying the principles of logarithms:

$$\log P = 2 \log I + \log R + \log T - \log 4180$$

and rearranging in the order in which they will be plotted for slide rule scales:

$$2 \log I + \log R + \log T - \log P = \log 4180$$

Thus, the plot of $2 \log I$ will be made on the lower stationary scale and that of $\log P$ on the upper stationary scale; $\log R$ and $\log T$ will be placed on the lower and upper scales respectively of the sliding scale. Having determined the arrangement of scales, the limits of each variable are set and the value of the scale modulus calculated such that the length of the longest scale will not exceed 10 inches, the size of our slide rule blank. Using the scale modulus, the length of each scale is calculated. This work for the problem under consideration is tabulated in Table I.

TABLE I

Summary of the Characteristics of Each Scale

Variable	I	R	T	P
Limits of Variable	5-50 amp.	20-220 ohms	400-3600 sec.	500-100000 kg.-cal.
Function	$2 \log I$	$\log R$	$\log T$	$\log P$
Scale Modulus	4	4	4	4
Length of Scale	8.00 in.	4.16 in.	3.80 in.	9.20 in.
Equation of Scale	$8 \log I$	$4 \log R$	$4 \log T$	$4 \log P$

The graduation of each scale is obtained by geometrical projection, using a reduction diagram. The application of this method for obtaining the graduations of $8 \log I$ scale is shown in Fig. 3. Following the same procedure, the graduations of the other three scales are similarly obtained. The summary of the data obtained by projection for the direct plotting of the scales is shown in Table II.

Congratulations

to the

HENRY B. GILPIN COMPANY ON A CENTURY OF SERVICE

The Henry B. Gilpin Company is celebrating its Centennial Anniversary. The J. T. Baker Chemical Co. wishes to congratulate this fine Company which has enjoyed the confidence of the drug trade all these years.

As wholesale druggists, as manufacturing pharmacists, as druggists sundrymen and as distributors of—

"Baker's Analyzed"

C.P. Chemicals the name Henry B. Gilpin Company stands for quality—understanding—and prompt service.

During the last 12 years The Henry B. Gilpin Company have distributed **"Baker's Analyzed"** C.P. Chemicals and Acids. The sales growth of these popular laboratory reagents has been marked — a tribute to the outstanding sales ability and service provided by this distributor.

HENRY P. GILPIN COMPANY

NORFOLK, VA.

BALTIMORE, MD.

WASHINGTON, D. C.

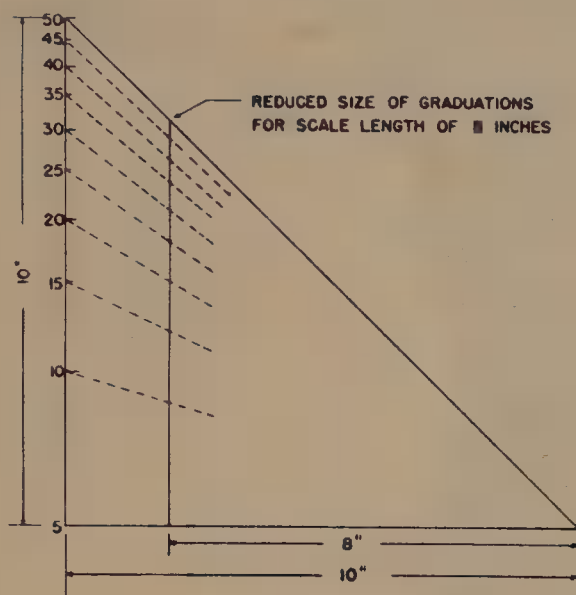


Fig. 3—Two-cycle logarithmic paper is used to obtain proper graduations along 10-inch line. Reduction of this scale to length of 8 inches is obtained as shown.

TABLE II

Linear Distance of Scale Graduations in Inches

<i>I</i>	Length	<i>R</i>	Length	<i>T</i>	Length	<i>P</i>	Length
5	0.00	20	0.00	400	0.00	500	0.00
10	2.41	40	1.19	800	1.19	1000	1.20
15	3.83	60	1.91	1200	1.88	1500	1.90
20	4.89	80	2.41	1600	2.39	2000	2.43
25	5.59	100	2.78	2000	2.81	2500	2.80
30	6.24	120	3.11	2400	3.09	3000	3.12
35	6.78	140	3.38	2800	3.36	5000	4.00
40	7.23	160	3.62	3200	3.59	7500	4.70
45	7.64	180	3.81	3600	3.80	10000	5.20
50	8.00	200	4.03			20000	6.40
		220	4.16			40000	7.64
						60000	8.33
						80000	8.84
						100000	9.20

Before the scales can be plotted it is necessary to determine their direction, *i. e.*, whether they increase from right to left or *vice versa*. If an equation is written in the form in which it will be plotted for the slide rule (first term of

"Baker's Analyzed" CHEMICALS

ALABAMA, BIRMINGHAM
McKesson & Robbins, Inc.
Doster-Northington Div.

CALIFORNIA

LOS ANGELES
Braun Corporation

SAN FRANCISCO
Braun-Knecht-Heimann Co.

COLORADO, DENVER
Denver Fire Clay Co.
The Mine & Smelter Supply Co.

CONNECTICUT, WATERBURY
Apothecaries Hall Co.

FLORIDA, JACKSONVILLE
Surgical Supply Co.

GEORGIA

ATLANTA
Estes Surgical Supply Co.

SAVANNAH
Wachtel's Physician Supply Co.

ILLINOIS, CHICAGO
Central Scientific Co.
A. Daigger & Co.
Rascher & Betzold, Inc.
E. H. Sargent & Co.
Schaar & Co.

LOUISIANA, NEW ORLEANS
Murray-Baker-Frederic, Inc.

MARYLAND, BALTIMORE
The Henry B. Gilpin Co.

MASSACHUSETTS, BOSTON
Central Scientific Co., Eastern Div.
Doe & Ingalls, Inc.
Howe & French, Inc.

MICHIGAN

ANN ARBOR
Eberbach & Sons Co., Inc.

DETROIT
Harshaw Scientific
Frank W. Kerr Co.
E. H. Sargent & Co., Michigan Div.

GRAND RAPIDS
Haviland Products Co.

MINNESOTA, MINNEAPOLIS
Physicians & Hosp. Supply Co. Inc.

MISSOURI

KANSAS CITY
Kansas City Laboratory Supply Co.

ST. LOUIS
Fisher Scientific Co.
Heil Corporation

NEW JERSEY

BLOOMFIELD
Scientific Glass Apparatus Co.

NEWARK
N. J. Laboratory Supply Co.

NEW YORK

BUFFALO
Buffalo Apparatus Corporation

NEW YORK CITY
J. & H. Berge
The Emil Greiner Co.
New York Laboratory Supply Co.
Will Corporation

ROCHESTER
Will Corporation

N. CAROLINA, RALEIGH
Southern School Supply Co.

★ **VANCOUVER**

★ **SEATTLE**

SALT LAKE CITY ★

DENVER ★

★ **SAN FRANCISCO**

★ **LOS ANGELES**

OHIO

CINCINNATI
Harshaw Scientific

CLEVELAND
The Chemical Rubber Co.
Harshaw Scientific

COLUMBUS
The Kauffman-Lattimer Co.

TOLEDO
The Rupp & Bowman Co.

OKLAHOMA, TULSA
The Refinery Supply Co.

PENNSYLVANIA

PHILADELPHIA
Harshaw Scientific
Arthur H. Thomas Co.

PITTSBURGH
Fisher Scientific Co.

TENNESSEE, NASHVILLE
Massey Surgical Supply, Inc.

TEXAS

DALLAS
Greene Bros., Inc.

EL PASO
Denver Fire Clay Co.
The Mine & Smelter Supply Co.

HOUSTON
W. H. Curtin & Company

★ **EL PASO**

UTAH, SALT LAKE CITY
Denver Fire Clay Co.

VIRGINIA, PHILADELPHIA
Phipps & I

WASHINGTON, PHILADELPHIA
Scientific S

WEST VIRGINIA, PHILADELPHIA
B. Preiser

WISCONSIN, PHILADELPHIA
Roemer D

Specify and Insist on... **"Baker's Analyzed"**

are stocked by these Laboratory Supply Houses



KE CITY
y Co.
lter Supply Co.
AMOND
nc.
SEATTLE
es Co.
A. CHARLESTON
nc.
MILWAUKEE

CANADA
MONTREAL
Canadian Laboratory Supplies, Ltd.
Fisher Scientific Co., Ltd.
TORONTO
Canadian Laboratory Supplies, Ltd.
Central Scientific Co., Ltd.
Ingram & Bell, Ltd.
VANCOUVER
Cave & Co., Ltd.

CUBA, HAVANA
American Chemicals Co.
PUERTO RICO, SAN JUAN
H. V. Grosch Co.
PHILIPPINE ISLANDS, MANILA
Philippine American Drug Co.

Baker's Analyzed

equation on lower stationary scale, second term on lower movable scale, third term on upper movable scale and fourth term on upper stationary scale), then the scale of the third term will have the same direction as that of the first and the fourth scale will read in the same direction as that of the second unless their algebraic signs differ, in which case a reversal of direction occurs. Applying this rule to our present equation,

$$2 \log I + \log R + \log T - \log P = \log 4180$$

it is seen that the scales of $2 \log I$ and $\log T$, the first and third terms, increase in the same direction; the scale of $\log R$, the second term, increases in the opposite direction to that of $2 \log I$ and $\log T$. But $\log P$ scale, since its sign is negative and different from that of the second term, increases opposite in direction to that of $\log R$.

The directions of the scales having been determined, we are now ready to begin plotting each scale on stiff paper. The application of the data in Table II to the direct plotting of scale $8 \log I$ is shown in Fig. 4. The other three scales are so drawn, keeping in mind that scale $4 \log R$ increases from right to left.

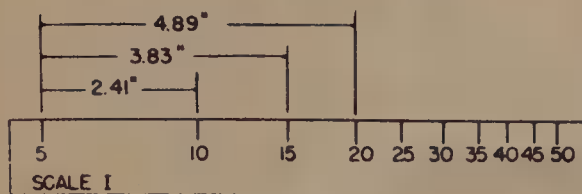


Fig. 4—Method of graduating scale by use of the data obtained by projection.

on the slide rule blank. Each scale is properly marked, the equation stated to identify the use of the rule, and the name of the firm or individual originating it included. The proper alignment may then be checked by solving a few problems, the answers of which are known. The completed slide rule is shown in Fig. 5.

The plotting of scales completed, we are prepared to locate the scales with respect to one another. Since scales $8 \log I$ and $4 \log P$ are the two longest, they are placed such that their left-end values are in alignment, the 500 directly above the 5 on the scale of I . Then, by substituting values in the original equation, the two remaining scales are located and glued in position.

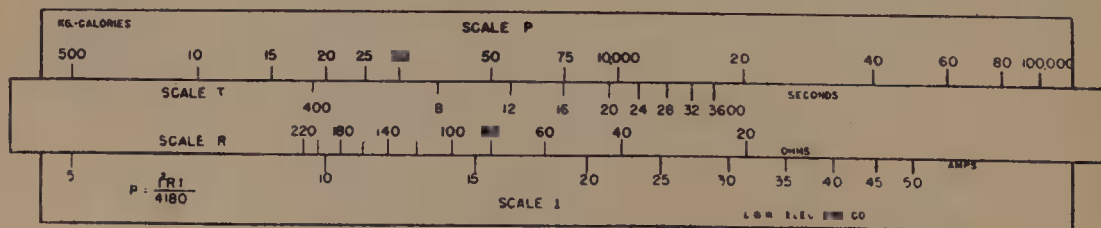


Fig. 5—The completed slide rule.

The accuracy of a solution by slide rule is dependent on the accuracy of both plotting and alignment. Vertical lines and graduations should be no

wider than for purposes of visibility and legibility. Graduations should be labeled and varied in length that readings can be made at a glance without tedious counting.

The above discussion is not intended to be an exhaustive treatment of the theory but rather an introduction to the fascinating mechanics of one of the most useful of mechanical computing devices, the slide rule. The equation developed is a simple one, but the principles used in its construction apply equally well to the many varied and complicated equations encountered in routine duties of the shop and office.

Detection of Beryllium in Copper-Base Alloys

Continued from page twenty-nine

Interfering Elements

The following elements, present in the amounts indicated, were found not to interfere:

copper	0.9970 g.	silicon	0.0154 g.
nickel	.0771	tin	.0991
manganese	.0321	lead	.0974
aluminum	.0400	antimony	.0055
cadmium	.0116	phosphorus	.0062
arsenic	.0027	zinc	.2707
iron	.0167		

In addition, Komarovskii and Poluektov (1) state that Co, Ag, Ca, Sr, Ba, La, Pr, Nd, Ce, Zr and Th do not interfere.

Acknowledgment

The author is indebted to R. Sass and R. E. Ricksecker of the Chase Brass and Copper Company, Inc., for furnishing several of the alloys used in the experimental work.

LITERATURE CITED

- (1) Komarovskii, A. S., and Poluektov, N. S., *Mikrochemie*, **14**, 315 (1934); C. A., **28**, 6387,
- (2) Feigl, F., "Qualitative Analyse mit Hilfe von Tupfelreaktionen," 2. Auflage, 244, Akademische Verlagsgesellschaft m.h.H., Leipzig, 1935.

BUY WAR BONDS — DO IT NOW!
VICTORY IS WORTH WHATEVER IT COSTS.

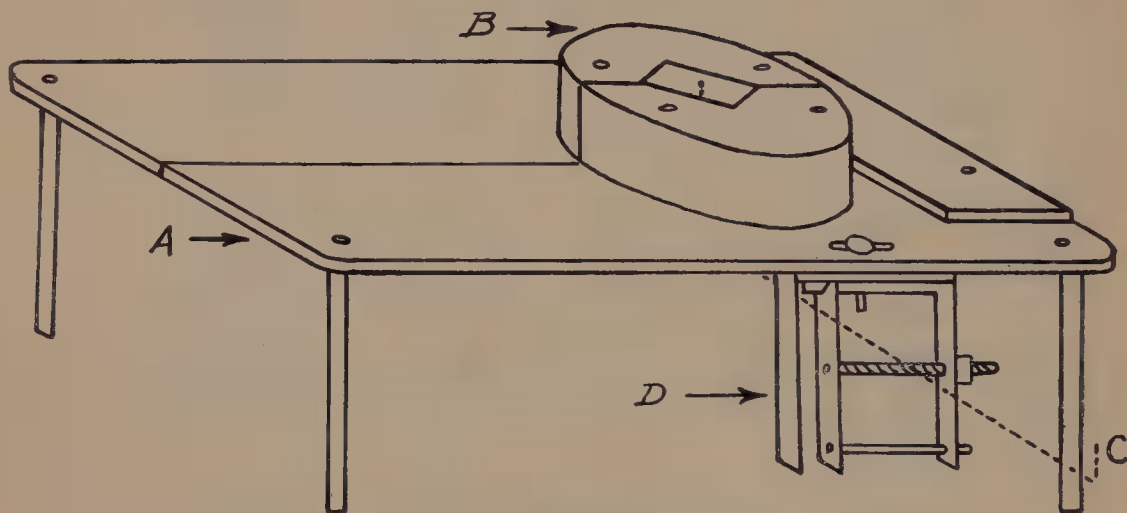
LABORATORY SUGGESTIONS

Note on A.S.T.M. Test D 61 - 38

E. PASOLD

Ruberoid Company, Erie, Penna.

In using this cube-in-water method for measuring the softening point of a tar product trouble has been experienced in getting reproducible results. As usually performed, the cube of material undergoing test is provided with a hole to accommodate the wire hook on which it is supported. Thus the cube is free to turn and often does so, with the result that duplicate determinations differ by more than the specified 1.0°C . This can be prevented by placing the hook in the mold and holding it in the proper position while the pitch is being poured. A perspective drawing of equipment suitable for this purpose is shown here.



The brass plate, *A*, has a thickness of $\frac{1}{8}$ " , a width of $2\frac{1}{2}$ " and a length of 5". It is cut in half and hinged in order that the mold may be split. This plate is supported on four legs at a height of $1\frac{3}{4}$ ". It accommodates two molds only one of which, *B*, is shown in the drawing. These molds are permanently attached to the plate by means of rivets. At the center of the mold a hole is drilled through the plate in order to accommodate the wire hook, *C*, which is held in place by the pinchcock, *D*.

The plate as well as the mold should be amalgamated to prevent the pitch from adhering to them.

Self-Draining Filtering Flask

JOHN SIMILA

Oregon State Department of Agriculture, Salem, Oregon

A self-draining filtering flask can be easily made from a Kjeldahl flask, the other materials required costing only a few cents. Such a flask is often convenient; for example, the filtrations involved in a large number of crude fiber determinations can be made without the trouble of stopping to empty the flask. The author has used one regularly and finds it very practical.

Heat the bottom of a 800 ml. Kjeldahl flask in a strong flame and form a tubulature by inserting a $\frac{1}{4}$ " iron rod through the neck of the flask. The side tubulature *E*, about $2\frac{1}{2}$ " from the top of the flask, is made in like manner with a $\frac{1}{4}$ " iron rod bent at a right angle.

Blow a $\frac{3}{8}$ " bulb, *D*, on the end of a piece of 3 mm. glass tubing and draw the tubing out so that the bore will fit the wooden rod *A*, 2 mm. in diameter and about 4" long. (An applicator stick, such as is used in any bacteriological laboratory or employed by a doctor, will serve the purpose.) Cut off the glass tubing at a distance of about $\frac{3}{4}$ " from the bottom of the glass bulb.

Fit the bottom tubulature with the one-hole rubber stopper *C*, which provides the seat *F* for the glass bulb *D*.

Punch a hole through the sides of a 1" length of $\frac{1}{4}$ " rubber tubing, *B*, and push the wooden rod, *A*, through the holes until the rubber tubing is approximately in the middle of the rod.

Now place this assembly, *A* and *B*, inside the Kjeldahl flask by forcing it down through the neck. One end of the wooden rod will drop through the bottom tubulature to which has been fitted the rubber stopper, *C*. Pull this end through the stopper until the rubber tube *B* comes within about 1" from the other end. The glass tube with attached bulb, *D*, is then slipped over the outside end of the wooden rod and firmly affixed to it with a suitable alkali-resisting cement.

In order that the valve may operate properly, the clearance between the bulb *D* and its seat *F* should be $\frac{1}{8}$ " without bending the rubber tubing *B*. To make this adjustment insert glass tubing through the neck of the flask, over the wooden rod *A* and against the rubber tubing *B*. Then press the bulb *D* against *F* with one hand and slide *B* along *A* until the proper clearance is attained.

This valve operates automatically. When suction is applied, the in-rushing air carries the bulb *D* against the seat *F*, thus closing the valve. When the suction is released, the hydrostatic head of the liquid in the flask forces the bulb away from *F*, allowing the filtrate to flow away completely and rapidly.

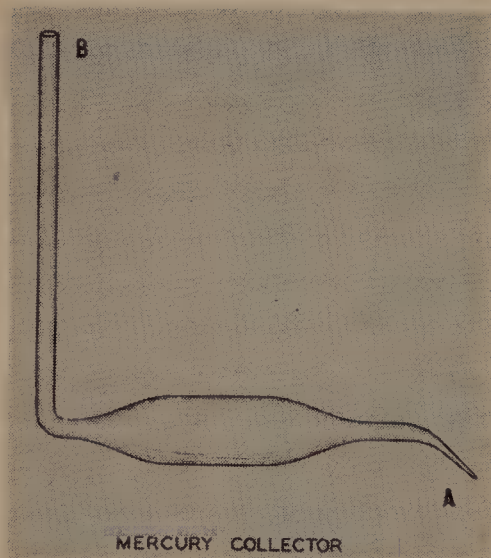


Collection of Spilled Mercury

E. T. PINKNEY and R. S. YOUNG

Nchanga Consolidated Copper Mines Ltd., Chingola, N. Rhodesia

Most chemists from time to time have experienced the exasperating task of collecting mercury from benches, floors, or sinks, following a breakage of glass apparatus containing this liquid or after attempting to fill small bore tubes with mercury. Apart from the high cost of mercury and the great difficulty of obtaining it in wartime, from the standpoint of health this metal should not be allowed to remain in cracks or crevices around a laboratory. Many workers have emphasized the danger from prolonged exposure to small concentrations of mercury vapor in the atmosphere (1). The accepted limit for mercury in a working atmosphere is 0.1 mg. per cubic meter of air (2). This is actually about one part of mercury by volume per hundred million parts of air.



Spilled mercury may be easily collected with the aid of the device illustrated in the accompanying figure. A 25, 50, or 100 ml. volumetric pipette is bent in a flame so that the upper tube *B* is at right angles to the bulb of the pipette. The other end of the pipette, which normally comprises the tip, is heated close to the bulb, drawn out to a fine bore approximately 1 mm. in diameter and at the same time is bent downwards. After cooling, the tube is cut off about 2.5 cm. from the bend, as shown at *A* in the diagram. Obviously a pipette discarded on account of a broken tip is perfectly satisfactory for this work.

By attaching the end *B* to a vacuum line or water suction pump with the aid of a suitable length of pressure tubing, mercury is drawn into the pipette through *A*. Dirt and dust, water and other liquids pass out through *B*, while mercury remains behind in the bulb. To transfer the mercury to a bottle, close the suction line and tap the pipette so that mercury runs out *A*. If necessary, slip the rubber tubing off end *B* and tip the pipette to allow the mercury to run out this end. The length of the upright tube *B* should be at least 6 inches in order that very fine particles of mercury will not be carried out of the pipette mechanically by the air stream.

LITERATURE CITED

- (1) Burke, W. J., Moskowitz, S., Siegel, J., Dolin, B. H., and Ford, C. B., "Industrial Air Analysis", *N. Y. State Dept. Labor, Div. ind. Hyg.* (1943).
- (2) Snell, M. A., *Chem. Met. Eng.*, **50**, No. 10, p. 181 (1943).

TIME SAVERS— FOR THE BUSY CHEMIST



Reagents with the
actual analysis
on the label

WAR CREATED many new problems of quality control for countless companies. Chemists had to set up wider laboratory control methods — and all too frequently with less manpower.

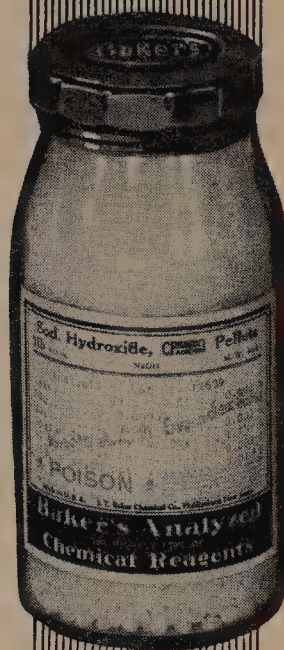
Quick analysis with accuracy was the goal, for every minute counted. Chemists sought working tools that enabled them to chart their **courses** safely but swiftly. Among these tools of measurement were—

"Baker's Analyzed"

C. P. Chemicals and Acids.

Always popular because of their dependability, these reagents with the actual analysis on the label took on a new wartime significance. They saved the chemist's time. For the actual lot analysis on the label gave the chemist defined purity to the decimal rather than maximum limits of purity.

That's another reason why **"Baker's Analyzed"** C.P. Laboratory Chemicals are pyramiding in popularity. It's another reason why we maintain large and well-balanced stocks ready to fulfill every war requirement.



HOWE & FRENCH, INC.,

99 Broad Street,

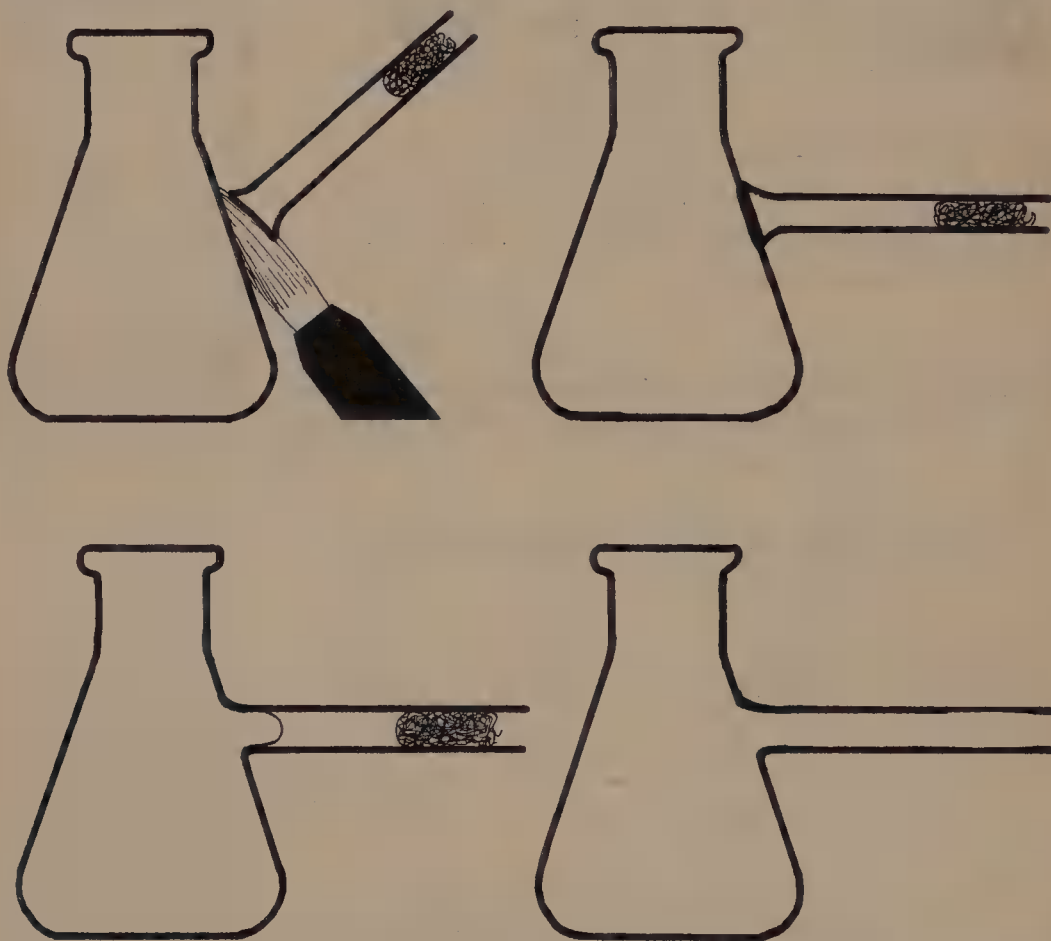
Boston, Massachusetts

The Suck-Seal

ARTHUR FURST

San Francisco Junior College, San Francisco, Calif.

For some unknown reason none of the books on glass blowing have incorporated the technique of placing side stems by the suck-seal. Although the writer cannot recall where he has learned this method, no originality is claimed for it. However, the number of times that he has had the occasion to demonstrate it to experienced glass blowers makes him feel that this simple technique is not as widely known as previously believed and thus may justify this note.



To place a side stem on any tube or in some awkward place on a flask or beaker, the following method is used. The side stem is flanged in the usual manner and a small piece of cotton is inserted in the other end of the tube. The spot where the side stem is to go on is heated with a needle flame until the spot is plastic. The heated flange is placed on the plastic spot, and then the operator sucks hard. (When placing the flanged tube on the plastic spot, care must be taken that the tube is not pushed in.) A thin film of glass is sucked out. As the plastic glass is drawn through the tube it contacts the side, making a permanent joint. If this film of glass breaks as it is being sucked out, the cotton prevents it from entering the mouth. No extra work-

ing is necessary; the joint is merely heated again and annealed. When cool, the thin film of glass is broken with a piece of wire.

The main precaution is to see that the spot is heated hot enough; otherwise the film that is sucked out will be too thick and will not break. There is no remedy for this.

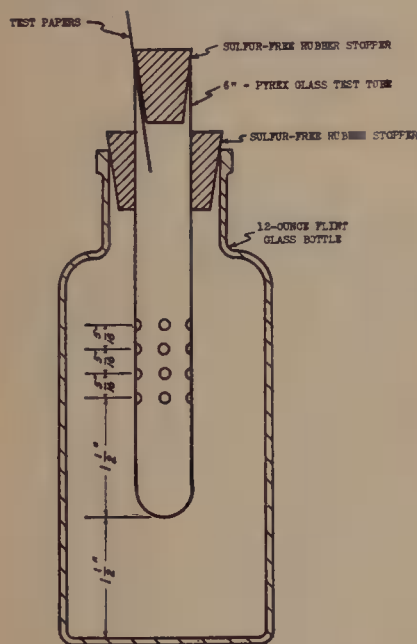
Concurrent Humidity Tests at Various Relative Humidities

ALEX NEWHOUSE and JAMES H. STEELE

American Cyanamid & Chemical Corporation, Newcastle, Pa.

In developing new products it is often necessary to determine chemical stability at various temperatures and relative humidities. This is especially true in cases where the products are to be subjected in the course of normal use to widely differing atmospheric conditions.

Ordinarily it is necessary to submit test samples to one relative humidity in a humidity chamber until the test is completed, before another relative humidity is employed. This is time-consuming unless a number of humidity chambers are available, which is usually not the case in view of the considerable expense involved.



By means of the inexpensive apparatus shown here a number of samples have been conveniently examined simultaneously under a number of different relative humidities. The 6" Pyrex glass test tube is provided with sixteen holes, $\frac{1}{8}$ " in diameter. These are arranged in four horizontal rows, spaced $\frac{5}{16}$ " apart.

The material to be examined is placed in the bottom of the test tube which is then stoppered, indicator papers being inserted between the stopper and the mouth of the test tube so that any possible decomposition can be readily followed. Solutions for maintaining the constant humidity desired are placed in the 12-ounce bottles. Information about these solutions can be found in Lange's handbook (1).

If it is desired to conduct the test at an elevated temperature, this can be done by placing the apparatus in a laboratory oven or constant temperature bath.

This arrangement can easily be modified by placing the sample in a shallow basket of suitable material and suspending it over the salt solution by means of wires attached to a solid rubber stopper in the mouth of the 12-ounce bottle.

LITERATURE CITED

- (1) Lange, N. A., "Handbook of Chemistry," Fifth Edition, 1412-3, Handbook Publishers, Inc., Sandusky, Ohio, 1944.

A Sampling Device

RICHARD W. STOW

United States Department of the Interior, Fish and Wildlife Service,
Patuxent Research Refuge, Bowie, Maryland

In a series of determinations on dried bird excrement, nonhomogeneous though finely ground, much difficulty was encountered in securing a representative sample. Two types of particles were present in the ground sample. One, apparently heavy and rather fine in texture, continually tended to separate and settle from the other light chaff-like substance. If it were possible to obtain a column, representing material from all levels of the sample, the difficulty might be avoided. The device described below was made in the hope of accomplishing this purpose and has been used with gratifying results.

Description

The sampler consists of two parts. One, an inner cylindrical plunger (Fig. 1) with slotted side walls *C*, moves freely along its axis inside the outer cylindrical sheath (Fig. 2). In use the sheath is pulled up, exposing all except the uppermost part of the slotted plunger. In this position the device is lowered into the weighing can containing the sample until the bottom disc of the plunger rests on the bottom of the can. The sampler is then moved

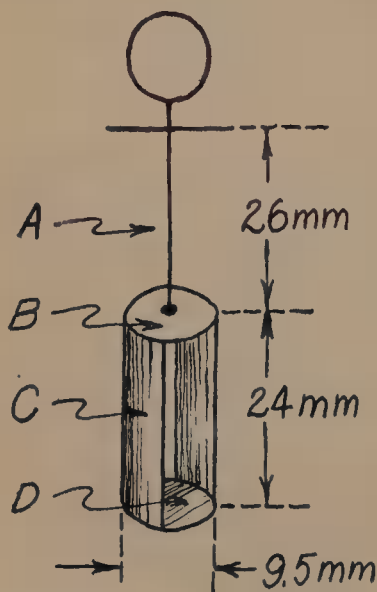


Fig. 1.

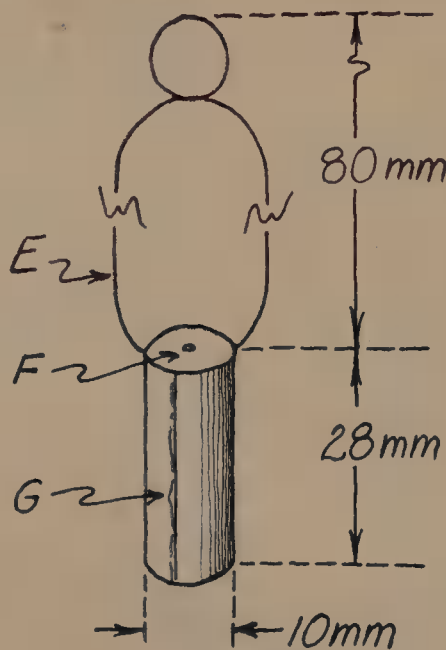


Fig. 2.



Fig. 3.

around in the can with the motion always in the line of the slots, causing a flow of the can contents through the plunger. In order to extract the sample, the outer sheath is lowered by forcing its handle down. The sample, now trapped inside the sheath, may be removed from the can and transferred to the desired vessel. In this laboratory the device has been used in the differ-

ence method of weighing samples. In order to exclude the error due to particles of the sample clinging to the sampler, it was hung on the hook below the stirrup carrying the balance pan and weighed with the can containing the sample. When samples are changed, a short blast of air on the apparatus serves to clean it.

Making and Assembly

The sidewalls, *C*, and the top and bottom discs, *B* and *D*, of the plunger were made of sheet copper, 0.25 mm. in thickness. The handle, *A*, was made from pieces of paper-clip wire, about 1 mm. in diameter. The outer sheath *G* was made of copper foil 0.05 mm. thick, wrapped to form the cylinder, and the top disc *F* of 0.25 mm. copper. The disc *F* in the top of the outer sheath serves as a guide for the handle of the inner plunger. The handle *E* for the sheath was also made of paper-clip wire. Soft solder was used on all joints. A small wire crosspiece was soldered to the handle of the inner plunger, acting as a stop to prevent the two parts of the device from becoming separated. In assembly, the wire forming the handle of the inner plunger was left straight until it had been put through the hole in the top disc of the sheath. Then the loop was bent and the crosspiece attached. The assembled sampler, with the plunger partly exposed, is shown in Fig. 3. It weighs about 6 g. and has a capacity of about 0.5 g. of dried plant or fecal material.

Adjustable Constant Temperature Bath

E. C. URBAN and J. A. DIETZ
General Electric Co., Schenectady, New York

Some time ago it was desired to have a constant temperature bath which could be adjusted to maintain different temperatures as experimentation proceeded. It was found that the boiling point of glycerol is rapidly lowered by the addition of small amounts of water, as shown by the approximate values of the following table:

% Glycerol	Boiling Point
100	280° C.
99	225
98	195
97	180
96	170
95	160

A three-neck flask is fitted with a condenser and a thermometer; a test tube in the third neck accommodates the material to be maintained at the constant temperature. The glycerol in the bath is heated to the desired temperature with an electric heater. Then water is cautiously added drop by drop until the mixture is boiling smoothly at the desired temperature. To raise the temperature of the boiling point, disconnect the condenser for a few minutes to permit the escape of water vapor. The temperature of the boiling point is lowered by dropping water down through the condenser.

Since we developed this constant temperature bath, we have learned that the idea is an old one. However, it was new to us and may be to others.

•• MISCELLANY ••

An Aid in Kjeldahl Nitrogen Determinations

REGINALD R. LEWIS
Malaga Trading Company, Lindsay, Calif.

Granulated zinc, 40 mesh is a very effective antibumping agent in Kjeldahl flasks during distillation. As a dispenser for the zinc, use a Schuster dropping bottle with the diameter of its spout adjusted to deliver the zinc granules. This device avoids spillage and is a convenience when many nitrogen determinations are being made every day.

Cleaning Laboratory Glassware

D. M. RIGGIN
Gulf Oil Corporation, Tulsa, Oklahoma

While burettes and other volumetric glassware should be cleaned occasionally with chromic acid solution too frequent use of this method is injurious to etchings, etc., on the glass. It has been found that new detergents, such as "Dreft," which are sodium alkyl sulfates, are superior to ordinary soaps for such frequent cleaning as may be necessary, as their use is possible in hard water, salt water or in slightly acid solutions where ordinary soaps fail. Since their calcium and magnesium salts are soluble, there is no adhering scum left after use with hard water as is the case with ordinary soap.

Note on Filtering with Asbestos Fibers

LESLIE W. REES and BARBEE W. DURHAM
Laboratory Supply Stores, Ohio State University, Columbus, Ohio

In using asbestos fibers as the filtering medium in a 6" Büchner funnel we had difficulty with the floating of the fibers. This has been overcome by placing an inverted 5-hole desiccator plate on the asbestos mat. Besides holding the fibers in position, the solid center of the plate affords a place where the solution being filtered can be introduced at a rapid rate.



FOODS - MEDICINES - AMMUNITIONS - SUPPLIES *all require Measured Purity*

They are unloading war supplies in the Pacific. Precious cargo this. And the quality of practically every piece unloaded had to have an O. K. from the chemist.

FOODS frequently had to be fortified. Nutrient values had to be safeguarded. Fighting men had to be kept strong, healthy, and fit. The food chemist with one of his dependable allies **"Baker's Analyzed"** C.P. Reagents helped make this possible.

DRUGS — SERUMS — MEDICINES. Huge quantities were needed. Infection had to be prevented or arrested. War casualties had to be reduced—lives saved. The chemists of many drug and pharmaceutical laboratories use Baker's measured purity two ways —

"Baker's Analyzed"

C.P. Reagents to test and control quality — Baker's fine chemicals as ingredients in the products themselves.

AMMUNITION AND SUPPLIES. You know the answer here. Behind the active hands of war industry the chemist controlled the quality whether the product was ammunition, guns, jeeps, airplanes, ships, or communication systems. And back of the chemist's decisions was his reliance on his laboratory reagents.

If you have special chemical requirements for war production or in anticipation of post-war needs — if you require measured purity to predetermined standards we invite you to discuss your problem in confidence with Baker. We may be able to help you, for Baker Chemicals are kept abreast of industry's exacting needs.
